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Maintaining Urban Industrial Land Use to Accommodate New Craft and Light Industrial Economies

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Maintaining Urban Industrial Land Use to Accommodate New Craft and Light Industrial Economies

by

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Abstract

Maintaining Urban Industrial Land Use to Accommodate New Craft and Light Industrial Economies

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This report will examine the issue of declining urban industrial land use and analyze how cities might benefit from maintaining industrial-zoned land or reconfigure the definition of industrial use in order to accommodate new craft and light industrial economic activities.

In order to accommodate both population and economic growth, several U.S. cities are currently faced with the challenge of either changing or maintaining existing land uses so they can provide housing, as well as commercial space for businesses to grow. In many cases, the high demand for housing has overtaken other priorities, such as maintaining industrial pockets, which has led to rezoning for mixed-use commercial and residential development. While a change in land use is beneficial for expanding housing supply, it is disregarding a possible need for new urban economic activities such as small shop inventors, artisanal bakers, home brewers, craft manufacturers – sometimes labeled the maker movement.

The initial section of the report illustrates historical and current trends in industrial land use and zoning. I will also define industrial zoning and establish whether or not its definition is possibly irrelevant given today's uses of such spaces. The paper will then see if scant industrial space is, indeed, an issue amongst cities and if they are seeing a rise of interest for designated zones to create clusters of industrial activities that may benefit from co-location opportunities. I will then explore what types of businesses can best benefit from urban manufacturing space, but may find it a challenge to find adequate space in their city due to zoning changes. I will then use the experiences of three cities that have designated industrial zones for PDR, or Production, Distribution and Repair, use or for light industrial use in order to provide warehouse and activity spaces for burgeoning businesses. Finally, the paper will discuss the importance of industrial spaces to the diversity and economic growth of US cities.

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Chapter 1: Introduction

OVERVIEW

As many U.S. cities are transforming planning frameworks to accommodate rapid changes in their economic and demographic structures, a sharp reduction in urban land zoned for industrial use has emerged as a significant issue. The past fifty years has seen a precipitous decline in manufacturing facilities and sites in core US cities. In many cities this land has been reallocated to residential and commercial uses to meet changing demands for urban space. But extensive rezoning of industrial land and the lack of attention to ongoing or potential industrial uses in contemporary comprehensive planning processes raises important questions for planners. Should we continue to make a place in our cities for manufacturing activities to sustain economic diversity and goods producing workers? In addition, are recent changes in consumer preferences favoring entrepreneurial craft production opening up potential growth sectors in urban economies that could be hindered by the lack of industrial land and facilities?

To address these important land use issues I will explore trends in land use allocations and analyze the supply and demand for industrial land uses. Specifically I will address the following questions:

1. To what extent have US cities reallocated industrial land to other uses?
2. Is there any evidence that the diminishing availability of industrially zoned land is constraining large and small manufacturing of goods making activity in US cities?
3. How might cities use their remaining industrial building stock and zoning to promote emerging craft and entrepreneurial manufacturing economic activities to promote economic diversity and development?

This report will examine the change in urban industrial land use and analyze how cities might benefit from maintaining industrially-zoned land or reconfigure the definition of industrial use in order to accommodate new craft and light industrial producers.

METHODOLOGY

Two methodological approaches will be used in this work. First current research from review of existing literature will be presented and discussed. Second, I will present three case studies of three cities that are currently undergoing land use reform in their industrial areas. In these cases I will draw from interviews I conducted with city planners from these cities who specialize in urban manufacturing.

The literature review is quite extensive on the topic of the supply of industrial land in cities. Maintaining industrial land uses has been a thoroughly examined objective for planners, based on documents and sites described from at least 20 cities. The literature includes job employment data in correlation with manufacturing economies, and the growth of the smart cities movement and manufacturing's status in these efforts to improve the sustainability of US cities.

The review identified three case study cities whose historical infrastructure was strongly shaped by an industrial economy. Philadelphia, San Francisco, and New York City are cities that once saw manufacturing as the epicenter of their commerce and job allocation. Overt time, industries evolved and the cities experience decentralization of industrial firms. Now each of these cases has an economic base dominated by service sector activities such as technical and professional services, retail, tourism and arts and entertainment. Yet all three are now challenged by needs and demands to reclaim industrial land for emerging manufacturing industries and activities, loosely characterized as a rising "Maker Movement".

Chapter 2: Industrial Land Use

BRIEF HISTORY OF INDUSTRIAL LAND USE

Industrial land has been a historically dominant feature in central cities whose urban core was defined by strong population growth and commerce from the 19th to the mid- 20th century. In light of stark housing concerns in the early 20th century, zoning and land use regulations were instated to alleviate poor living conditions of the working class, setting standards for where commercial, residential, and industrial buildings could be placed in relation to each other. At that time, industry was comprised of traditional artisan shops, small manufactories, trade-oriented raw material processors, and shipbuilders, often in large numbers and inhabiting the same neighborhoods as residential uses (Lewis 2004). In an effort to combine all uses together within metropolitan perimeters, industrial land was set aside in large, separated zones for industrial expansion (Lewis 2004).

As manufacturing firms began to multiply and grow in size, industrial districts started to develop to accommodate rising businesses. Because of the need for expansion and the demand for space by new and large-scale manufacturing, firms started to locate on the urban periphery. That is until railroads and expanding highway infrastructure created new and easier methods to provide transportation using new methods of shipping at lower costs outside of the city. This process accelerated with the rapid development of motor vehicle travel and interregional highways. This meant even faster transportation of goods, as well as less expensive and more accessible land further along highway stops. Consequently, both the labor force and location of large manufacturing firms began to decentralize from urban America and relocate to new suburban industrial cities outside of

city cores. Pittsburgh alone saw over twenty new industrial cities and boroughs created beginning in the early twentieth century (Lewis 2004).

The success and growth of US urban manufacturing industries started declining in the 1970's as industries began to send factory work to rural sites or overseas due to lower land and wage cost in rural and offshore locations. This urban deindustrialization was accelerated by improvements in telecommunications, and inexpensive transportation options. (Harlow 2010, Bluestone & Harrison, 1982). Central headquarter offices could now interact with distant international production locations using inexpensive transportation means, including air freight and innovative container shipping and logistics. Host countries offered low exchange rates, cheap labor, and more limited safety or environmental regulations, ultimately removing associated costs to manufacturers.

Between 1979 and 2009, the U.S. lost 7.5 million manufacturing jobs, dropping to a total of 12.5 million jobs in 2009. During this thirty-year period, the overall manufacturing sector decreased from 22 percent to 9 percent of total employment, leaving historically industrial urban and suburban cities with vacant, blighted, and underutilized factory buildings (Bronstein 2009).

Advocates for smart cities and smart growth prescribe urban cities to create more mixed-use and walkable communities that occupy vacant industrial sites for alternative uses in commercial, office, and residential (Bronstein 2009). While public perception sees industrial manufacturing and the existence of industrial sites as obsolete in today's times, there are still substantial figures arguing that employment in urban manufacturing remain significant. Zelda Bronstein argues optimistically how 12.5 million jobs in all U.S. cities is a strong figure, added to 11.6 other associated jobs in wholesale trade, transportation and warehousing, waste management and remediation, and repair and maintenance - all of which equals to about one-fifth of U.S. employment (Bronstein 2009). The top ten largest populated cities in the U.S. account for 4 percent of the 12.5

million manufacturing employment (American FactFinder 2012). The presence of manufacturing employment is not just beneficial for economic growth, but creates social equity for American workers striving to earn a middle class wage without obtaining advanced degrees.

In order to accommodate industrial employment and balance jobs and housing choices, it would benefit urban cities to not reclaim an excessive amount of industrial land for mixed-use commercial and retail or purely residential. For land use reasons, evaluating the need for blending industrial zoning into the urban core is an important consideration. Maintaining industrial land in the urban mix can enhance available living options for new and existing industrial employees, limit suburban sprawl, and sustain transportation options for those who can't afford longer distance auto travel, while also decreasing traffic congestion into the urban core.

THE EXTENT U.S. CITIES HAVE REALLOCATED INDUSTRIAL LAND

In Nancy Green Leigh's report, *Smart Growth's Blind Side*, she argues that industrial economic activity is essential to creating diverse, innovative, and more resilient local economies (Green Leigh 2015). Not only does industrial activity provide economic value to a city, but entices manufacturers to headquarter their offices in an area, as well as offer local opportunities for urban jobs.

According to Green Leigh, there is evidence of decreasing availability of land for industrial uses in urban areas. She reports that San Francisco reduced its industrially zoned land by 46 percent between 1990-2008, followed by Minneapolis –St. Paul at 18 percent between 1990 and 2005, and New York City with a 14 percent reduction between 2002-2007. All of these cities saw steep declines in manufacturing industries and have responded by converting the land to nonindustrial uses.

Thomas Lester and his co-authors in *Making Room for Manufacturing* found that the rise of high technology and a skilled service job sector in core urban areas was one of the factors for the reallocation of industrial land to other land use categories. The new population of workers and residents associated with these sectors found former industrial sites attractive areas for living and entertainment. Lester et al. studied North Carolina's Mecklenburg County, home to Charlotte, and Cook County, containing Chicago, to better understand land conversions. They found that Mecklenburg County lost 3,650 acres of industrial land to nonindustrial uses since 1990, with more than 54 percent converted to residential use. These sites were once apparel-manufacturing facilities, as well as computer, and electronic equipment manufacturing. At the same time, the number of jobs in apparel manufacturing fell by half, while technology manufacturing decreased by one-third over the study period (Lester 2013).

Cook County lost 4,750 acres – or 11.4 percent of its industrial land, with 46.2 percent of this converted to residential use. Lester found most of the converted sites in the Chicago area formerly housed printing and fabricated metals product industries before they were converted to new residential spaces. It was also found that conversion to residential uses followed transportation corridors that linked to more affluent and central locations. Alternatively, Mecklenburg also saw a growth in converted housing occur both in the central business district and outside the city center. New light rail projects in the Mecklenburg region will likely stimulate further conversion of manufacturing sites into service industry activity and commercial and residential buildings.

New York City saw drastic changes in industrial land use once Mayor Bloomberg came into office in 2002. The city once had 12,542 acres of land where manufacturing could operate legally. In 2009, during the same administration, the City had fewer than 10,746 acres with another 1,800 acres converted to other uses, including residential, commercial, and mixed-use. Only about 3 percent of the 10,756 acres of manufacturing-zoned land contains vacant and rentable space (Pratt Center for Community Development

2009). During this period of rezoning, between 2002 and 2007, New York City's 1,800 acres of rezoned property caused a 15 percent loss of manufacturing space (New York City Council 2014).

While in the process of losing 46 percent of San Francisco's industrial land between 1990 and 2008, the city redefined industrial use and salvaged 1,505 of the 3,254 that was industrially zoned during that period (San Francisco Planning Department 2002) (Central Waterfront Area Plan 2008). Yet, 7 percent of the available 1,505 acres was already programmed in 2002 for major redevelopments of primarily downtown commercial, office, and retail (San Francisco Planning Department 2002).

Cities	Industrial land use lost (acres)	% Lost (Of total industrial?)	Years
Atlanta, GA	800	12	2004-2009
Minneapolis- St. Paul, MN	1,812	18	1990-2005
New York, NY	1,797	14	2002-2007
Philadelphia, PA	1,645	8	1990-2008
Portland, OR	489	2	1991-2001
San Francisco, CA	1,276	46	1990-2008
San Jose, CA	1,470	9	1990-2009

Table 1: Loss of industrial land to rezoning in select U.S. cities (Green Leigh 2015).

However, these trends are becoming the object of a more careful analysis and scrutiny of possible demands for industrial land and sites. Scott Dempwolf's review of industrial land use studies found that at least 20 cities have made an effort to evaluate and inventory industrial land use (ILU). In his analysis, Dempwolf analyzed how, by addressing and planning for ILU, cities were able to define, or redefine, industrial land and prioritize their inventory. For instance, Seattle, San Francisco, and Washington, DC have recently decided to preserve existing and potential urban industrial sites by only allowing industrial mixed with office and retail. In turn, they've created production,

distribution, and repair (PDR) zones that designate land for select industrial uses. Other cities were more inclined to leave industrial zoning decisions to the market as interpreted by developers. Dempwolf believes the latter choice is less restraining on property values, specifically in cities – such as San Francisco or Seattle- where encroaching residential and live/work zones were impeding availability of industrial land (San Francisco Planning Department 2008).

Overall, while industry and geographical constraints may have played a part in the sharp decline of ILU, the current rise in light manufacturing and craft production presents planners with an important challenge. How can this type of production be accommodated along with the rise in urban housing development?

EVIDENCE OF CONSTRAINTS FOR MANUFACTURING

Large-scale manufacturing saw a steep decline during the 1980's and 1990's due to a weak dollar, rise in transportation costs, and wage competition from rural and international locales. Consequently, decentralization of manufacturing from urban areas occurred as manufacturing relocated to rural or offshore locations (Chapple 2014). With the surge in demand for urban living and revitalization of cities, small-scale manufacturing began to occupy old, vacant industrial spaces, in part to due to cheap land, low rents and wide availability of vacant spaces. Federal and local governments also saw this as an opportunity to urge new manufacturing industries to move centrally, as a way to reinvigorate urban economic development and boost U.S. exports.

In the report *The Federal Role in Supporting Urban Manufacturing*, Nisha Mistry and Joan Byron address the Obama Administration's support for creating place-based national economic growth by promoting urban and manufacturing growth as catalysts for regional sustainability, livability, and economic competitiveness. The report emphasizes that of the 51,000 manufacturers in the United States employing fewer than 20 people, more than a third were located in the nation's 10 largest cities (Mistry & Byron 2011).

Recent research has shown that manufacturers in urban areas are more productive than those in less dense areas. They also pay higher median wages than other types of employers in many large cities, while providing opportunities for workers with a wide range of skill levels (Mistry & Byron 2011).

As a means to inspire job creation and regional economic viability, many large U.S. cities have been proactive in their efforts to preserve industrial land use based on analysis of trends. Seattle, for instance, studied the level of real estate absorption and vacancy rates. While the last 2005 report showed a vacancy rate of 4.53% in the actual city of Seattle, a more recent 2015 report shows a very low industrial vacancy rate of 2.9% and $0.60-$0.75 per square feet cost of occupancy. This suggests that industrial land is scarce relative to demand and very marketable in Seattle.

Similarly, San Francisco produced a thorough *Supply/Demand Study for PDR in the Eastern Neighborhoods* report with a consultant, Economic & Planning Systems (EPS). EPS calculated square feet per employee, and current building/land relationships and characteristics. The report found that 27 million total square feet of Production Distribution and Repair (PDR) land would be required by 2030. At the time of the report in 2005 when the city was evaluating land, San Francisco could only provide 10 million square feet for these uses (Economic & Planning Systems 2005). Milpitas, California similarly found that 22 million square feet, or 145 acres would be needed by 2035 to accommodate a projected 53% increase in industrial and manufacturing employment (Conley Consulting 2007).

Washington, DC looked at both market reports and future land projections, concluding that its comparatively small 5 percent of industrial land was already in high demand and projected a future need for1.6 million square feet of land to accommodate industrial uses (Phillips Preiss Shapiro Associates 2006).

Boston, Chicago, San Diego, San Jose, and other cities found similar results. A major constraint for luring manufacturing into urban areas and accommodating expansion of local manufacturing activity is the projection of industrial land vacancy and availability. Without issuing flex or designated industrial zones, industrial land was going to be transformed to more profitable residential or commercial uses. While such land uses are greatly needed in urban areas, promoting mixed-used approaches that could accommodate light industrial and craft production is an important consideration.

THE MAKER MOVEMENT

Inspired by the rapid spread of computer and telecommunications technologies, the Maker Movement can be characterized by its broad set of manufacturing and craft activities, using rapid product manufacturing and new channels of market distribution provided by new production technologies and internet connectivity. This "new" craft economy is comprised of hobbyists, do it yourself makers (DIY), STEM students, and burgeoning entrepreneurs. According to the National League of Cities (NLC) *How Cities Can Grow the Maker Movement*, the concept was created in response to 1990's trends of outsourced technologies to overseas locations. The Maker Movement continues to gain momentum by an increase in participation of all kinds of people in interconnected communities, defined by interests and skills online as well as hyper-local efforts to convene those who share common goals (Dougherty). With the rise of 3D printing and new powers in computer technology, production of specialized parts can be done quickly with access to assistance that can be local or through global internet connectivity. However, NLC claims that the true leverage behind the movement stems from social connections and communications between people, made possible through online networking and colocation.

Planners and manufacturing professionals are skeptical about the maker movement's rise as a real economic force. Successes from existing maker platforms say that this phenomenon may be significant and growing. Etsy, a marketplace for everyday

DIYers across the world with vendors who sell their own paintings, furniture, jewelry, and clothing reported $1.35 billion in total merchandise sales as of 2013 (Deloitte 2015). Shapeways, a marketplace for 3D models, reported over 13,500 online storefronts, amounting to a $2.2 billion industry in 2012, which is expected to quadruple by 2020 (Bajarin 2015). The craft brewing industry contributed $55.7 billion to the US economy in 2014 (Brewers Association 2015). From clothing production, virtual reality gaming, robotic engineering and much more, there may be almost a million or more U.S adults who are considered makers and participants in various marketplace communities such as Maker Faire, Hackerspace.org, as well as driving small business growth (Deloitte 2015). A lot of these makers may be working from residential spaces, but those with growing businesses may need to expand their facilities and move to more appropriate spaces. The question is, where can they move to that is viable for the manufacturing and selling of their goods?

About 30 university libraries are providing spaces for students interested in creating or engineering products (Price 2013). Over 70 craft beer brewing establishments applied for permits in San Diego in 2014, and a manufacturing space company called Factorli received $10 million seed funding to create a 25,000 sq. foot industrial manufacturing space in downtown Las Vegas (Deloitte 2015). With substantial and growing numbers of maker-oriented businesses, an increasing demand for space should be a prominent consideration for local planning entities. Cities should be planning for this emerging economy because, above all, it is a new opportunity to diversify and strengthen local economic development that will require unconventional manufacturing spaces. Additionally, the very essence of the movement is oriented to urban markets and conditions.

According to Deloitte and Maker Media's report on the impact of this craft economy, the maker ecosystem can be seen as a disruption to today's large enterprise system that no longer needs significant scale to be successful. The maker movement is a

concept where individuals and small businesses share ideas in an environment suitable for ease of communication and collaboration. Urban areas are ripe for production of small-scale manufacturing businesses created and managed by workers living in the same community.

Several initiatives are already taking hold of the idea. A new system called makerspaces is on the rise, with over 2,000 such entities in existence around the world (List of Hacker Spaces 2016). Places like TechShop and NextFab, in Philadelphia, are open-space workshops where makers gather and exchange ideas using both simple and complex systems of machinery provided by the makerspace. By paying a monthly subscription to the shop, makers are able to model their concepts without having to invest in expensive equipment or office space or dedicate space in their homes. Similar spaces are also opening for incubation purposes, much like tech incubators. These shops are not just attracting hobbyists or inexperienced makers, but are being used by professional engineers looking to launch entrepreneurial businesses of their own. Makerspaces are perfect avenues for small-scale production and links to networking with potential collaborators, customers of financiers.

Occupying primarily light industrial spaces, makerspaces are also well suited for location in urban areas. They require less space than full-fledged factories, typically use clean technologies, and are able to expand vertically rather than horizontally. In addition, the prospective businesses they are helping to launch could potentially require more independent space once they are ready to expand on their own. With a demand for light industrial spaces, cities can dedicate mixed-use land types, like production, distribution, and repair (PDR) zones towards the business endeavors that TechShop, and NextFab are inspiring. For instance, NextFab in Philadelphia provides incubation for companies such as BioBots, developers of desktop 3D bioprinters that build 3D living tissues out of human cells. Love Robotics is a resident company at NextFab who build software for autonomous wheelchairs (NextFab 2016). TechShop San Francisco's Dodocase company

was once a subscriber of their service until the business relocated to a PDR zoned building in the Eastern Neighborhoods (TechShop, Dodocase 2016).

How Cities can use Industrial Zoning and Buildings to Promote Emerging Economies

It is generally believed that manufacturing jobs are, for the most part, good jobs for working-class communities. In New York City, they pay on average $49,000 a year, compared to $34,000 for retail positions (Pratt 2009). New York City Economic Development's (NYCED) State of Local Manufacturing report reports that most a majority of U.S. manufacturers are small in size with less than 10 workers who employs an average age of 56 with an hourly wage of $24.47 (NYCED 2013). The Manufacturing Institute reports that today's manufacturing employees earn higher wages and receive more generous benefits than other working Americans, with an 8 percent premium (Manufacturing Institute 2012). However, it is a misconception that manufacturing jobs are old-fashioned industrial revolution smoke stack assembly line companies with poor labor conditions. New techniques in manufacturing processes require technical knowledge in order to work with high-end machinery. They can also be innovative, hands-on, and pleasant spaces to work in. If manufacturing wants to lure a new population of makers and maker apprentices, once regarded as factory workers, they need to revise the setting and reputation of manufacturing.

For instance, LUSH Handmade Cosmetics was once a local shop created by two hairstylists in Dorset, UK. Now a $150 million dollar company with more than 670 shops across the world, the company is known not only for its unique natural bath bombs and cosmetics, but its modern take on a factory setting. LUSH has factories both in Canada and the UK that offer a living wage and modern, stylish working conditions that allow employees to experiment and create their own products with their name and face

caricatured on each tub of lotion or soap they've designed, which is then distributed globally.

Figure 1: LUSH factory floor in Dorset, United Kingdom
Figure 2: LUSH employee recognition on product

Taking this model of modern production facilities, manufacturing companies can lure new generations of trade students and even DIY enthusiasts who would prefer to work in a hands-on environment where they are able to contribute to actual products with their own creativity.

Where do cities fit into this? To hark back to Mistry and Byron's report, part of federal reform in manufacturing is to:

1. Develop a new narrative about manufacturing and metropolitan economies and use it to inform and guide its programs and policies.
2. Support small urban manufacturers' (SUM) role in regional cluster growth and development.
3. Help ensure that SUMs have the space, infrastructure, and technical assistance they need to grow and thrive (Mistry and Byron 2011).

In order to create sustainable communities, land use policies should support

diverse and resilient economies. Since small and large-scale manufacturing can carry positive paybacks for cities and their residents, boasting the competitive advantage of small manufacturing businesses in areas such as production of technology, electronics food, beverages, and various other goods cities should plan in order to ensure adequate industrial land availability.

In order to accommodate emerging industrial economies, one step that more than 20 cities have taken is to map their inventory of industrial land and use this information to inform creation of industrial land use plans (Dempwolf 2009). Philadelphia gathered an extensive inventory of its industrial parcels and developed a detailed plan for designating 15 districts and allocating industrial uses around the city. San Francisco introduced a new zoning tool called production, distribution, and repair (PDR) in its eastern neighborhoods which allowed for mixed-use of light industrial, residential, commercial, and retail. New York City designated manufacturing clusters called Industrial Business Zones and Industrial Employment Districts to preserve lucrative land from high-rise condo development. These cities all have economic development policies, which will be discussed in the case studies that entice business growth within the designated land accommodating industrial uses.

By dedicating industrial zoning, issuing city plans to control the supply of industrial land, and then instituting economic development policies to support new manufacturing activates, cities can offer an appealing business package for start-ups and existing manufacturing companies. Providing living wages in urban areas, which ultimately promotes livability in cities, these existing manufacturing companies can follow the model of modern production exemplified by LUSH.

Chapter 3: Case Studies

INTRODUCTION TO CASE STUDIES

As aforementioned, over 20 cities have created industrial land use plans to address concerns for economic growth in manufacturing. This section will examine how 3 historically industrial cities have identified their land use dilemma and implemented new concepts to accommodate manufacturing for economic diversification and growth.

The case studies were selected based on their long-term experiences with manufacturing economies and their abundance of industrial building stock. As global and popular urban cities, their planning objective to identify the loss of industrial land is part of the reason for applying them as best practices in this report. While smaller cities may not share similar manufacturing affordability and housing issues as the 3 case studies, they can still review the studies as best practices for recreating industrial zoning while still maintaining and introducing residential, office, and retail within the same corridors. The studies can also spark economic development tactics for cities looking to attract urban large and small scale manufacturing into their urban areas.

PHILADELPHIA, PA

Overview of Philadelphia's Industrial Land Use

Historically, Philadelphia has been an epicenter of industrial activity thanks to home rule charters and maritime and military presence (Wilhelm 1960). Founded on port activity, the city used rail and water as foundations for economic growth in apparel, food processing, metal fabrication, and construction. Consequently, infrastructure and manufacturing buildings are now widely available for their intended use. The city has always seen the importance of maintaining industrial growth within the urban area. In 1958, the Philadelphia Industrial Development Corporation (PIDC) was formed to slow

the migration of industrial companies to the suburbs at a time when one-story factory buildings were in demand (PIMLUS 2010). PIDC endeavored to create industrial districts along the city's periphery over the next fifty years to harness manufacturing growth. This was successful to an extent, but manufacturing began to decrease and Philadelphia became stagnant for almost four decades and the overall population dropped by nearly 22 percent between 1970 and 2010 (Pew 2014). In order to revive industrial activity and maintain economic growth, the city has recently detailed several industrial, manufacturing, and economic plans to help manage the availability of its industrial land and building stock.

The city's industrial land use plan is called *An Industrial Land & Market Strategy for the City of Philadelphia (*PIMLUS*)*. This report was a major initiative in which the Philadelphia City Planning Commission and Department of Commerce, together with consultants, took inventory of the city's existing industrial stock and districts and mapped, analyzed, and defined prospective activity for a whole new manufacturing city.

Nearly 21 percent, or 17,800 acres of Philadelphia is industrially zoned land. There are 15 industrial districts whose boundaries were formally designated by the report and subsequently used in ongoing effort to spur growth in these districts. Each district is characterized in terms of its current pros and cons for development as an industrial area, and then surveyed to establish its size, land use, vacancy, industrial parcel size, buildings, and recent developments (See Figures 3-5).

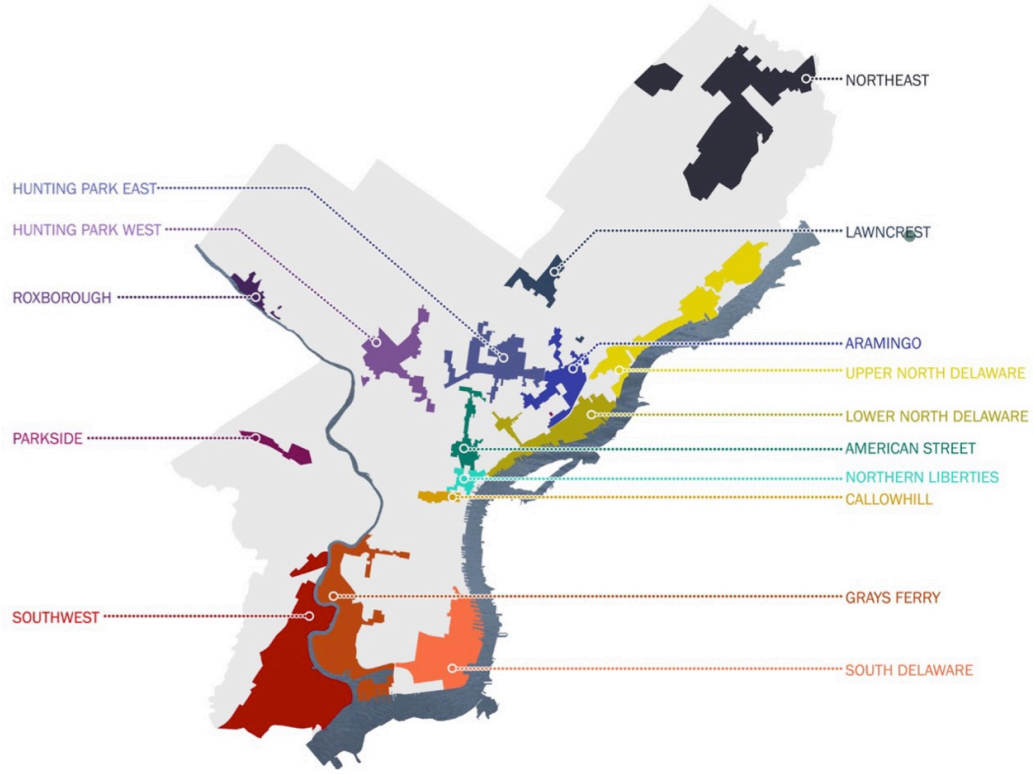


Figure 3: Surveyed Philadelphia Industrial Districts

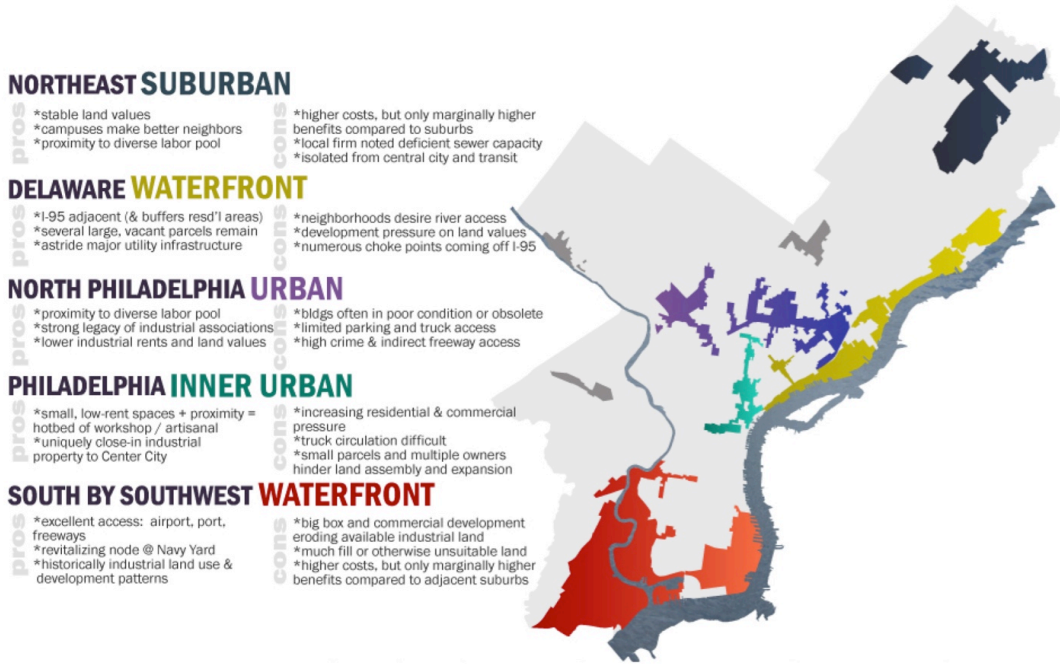


Figure 4: Industrial Area Characteristics

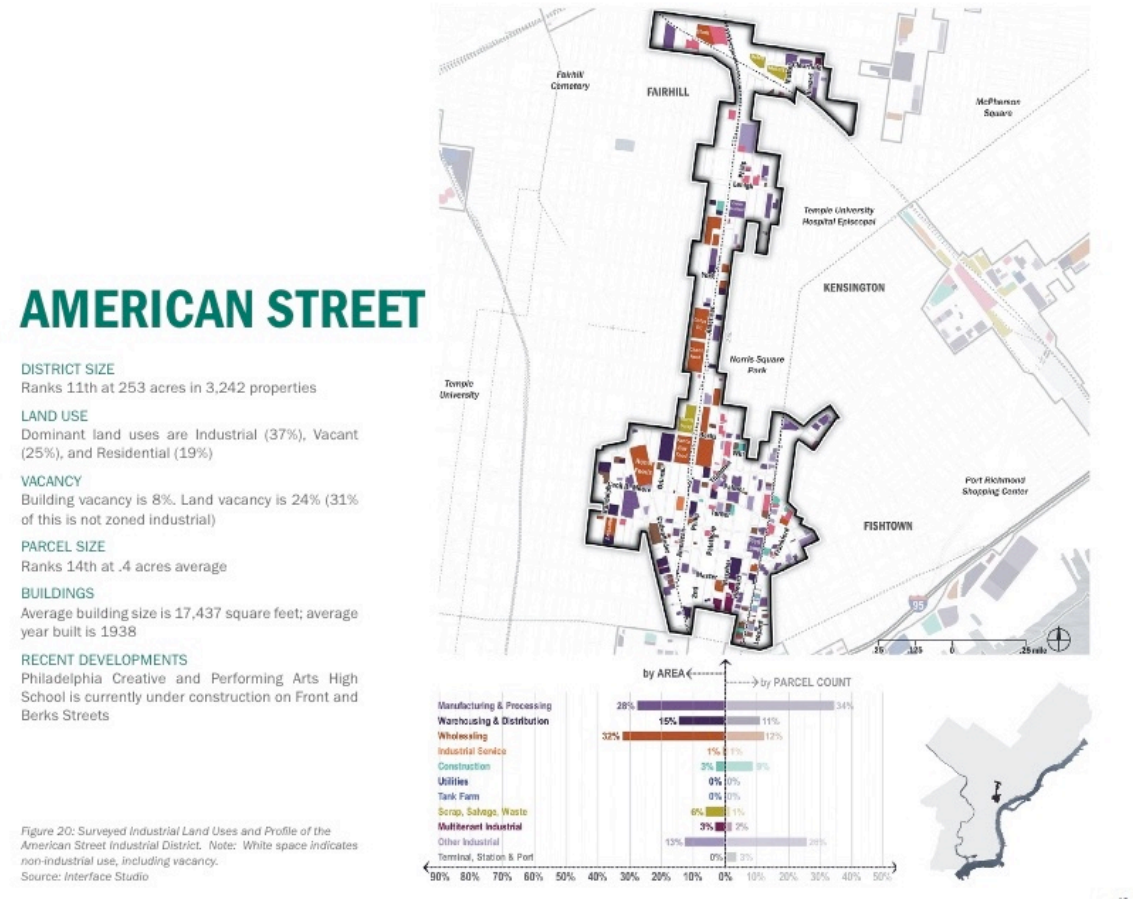


Figure 5: Surveyed Industrial Land Uses and Profile of the American Street Industrial District

Programs and Policies to Maintain Industrial Land Use

In the PIMLUS report, the city advises on changing the existing zoning to better support contemporary industry from the previous zoning code dating from 1962 where industries such as tanning, slaughterhouses, wagon repair, and typewriter manufacturing were still in existence. The historical code had once accounted for five industrial classifications that were entirely separate from each other in design and lot coverage. Instead, the new report recommendations are to allow modern forms of low-impact, high-performance, mixed-use industrial development. These zoning typologies are:

- Utilities and Transportation
- Heavy Industrial (I-3)
- Medium Industrial (I-2)
- Light Industrial (I-1)
- Industrial Commercial Mixed-use (ICMX)
- Industrial Residential Mixed-use (IRMX)

Accompanying the defined zoning categories is a map of where each typology of land uses currently exists. Additionally, a prescribed application of three distinct but complementary industrial typologies was introduced: Industrial Protection Areas, Industrial Intensification Areas, and Transitioning Areas. They are based on existing land use conditions and development trends and are intended to protect and grow the industrial job base within the city (PIMLUS 2010).

Aside from land use, the Office of Manufacturing & Industry for the City of Philadelphia have paired with the Department of Commerce to devise policies on attracting both businesses and developing and training a prospective workforce for a modern industrial economy.

Training and education in science, research, engineering, and manufacturing is being offered in local community colleges, technical education schools, and manufacturing high schools. The city is also striving to fund On-the-Job-Training

programs to assist employers with the cost of hiring and training a new employee. Public and philanthropic funds have been pooled together to train 252 individuals from 34 different companies to learn industry-recognized credentials.

The local government has provided specialized loans for small businesses to advance their industrial and manufacturing goals with its Working Capital & Equipment Loan Program and the economic development department's programs. In addition, the Pennsylvania Industrial Development Authority (PIDA) allows first time borrowers to apply for up to $400,000 for machinery and equipment. The Philadelphia Department of Commerce recently announced a partnership with the KIVA Zip program to provide small no-interest loans of up to $5,000 to entrepreneurs, makers, and small businesses in Philadelphia using a crowd-sourcing platform and a qualitatively-based underwriting process (Annual Report 2014).

There are also grants by the Ben Franklin Technology Partners (BFTP), a program in the state of Pennsylvania's Department of Community and Economic Development, to support their Advanced Manufacturing for the Medical Device Industry initiative. This program assists entrepreneurs in Greater Philadelphia to develop, commercialize, and manufacture medical devices, taking advantage of the rapid evolution of advanced manufacturing technologies. This is in response to Philadelphia's lag in technological advancements and the absence of the type of sizable venture capital presence that exists in such places as Silicon Valley and Boston.

So where does the Maker Movement fit into the Philadelphia scene? If anything, it is a very attractive city for maker companies looking for affordable and abundant manufacturing space located in the designated industrial districts.

Opinions on Maker Movement in the City

After conducting phone interviews with current and former Philadelphia planners, there seems to be mixed reviews about the Maker Movement. As far as land use, Ian Litwin of the City Planning Division commented that, "…a problem with Philadelphia is that there isn't much undeveloped land, aside from the Navy Yard and areas in the northeast, that are open for redevelopment. The city is stuck with legacy old industrial parcels that will only be used for maker industries or other uses, such as auto."

In terms of workforce and economic value, a former planner (name has been omitted upon request) in the Office of Manufacturing and former member of the development group, Philadelphia Industrial Development Corporation (PIDC) see the Movement as influential but not substantial,

"Philadelphia has a high poverty rate and a workforce that does not predominantly go to a four-year university. For people who have a high school education or maybe a GED, there's not a whole lot of opportunity out there other than retail [which does not offer a lot job growth and pay minimum wage] whereas industrial jobs, they pay a whole lot more…" In terms of space for a Makers Movement,

> "…you need to make sure people have the opportunity to be entrepreneurs and doing that means you have to have spaces where you can have co-working space. This is a very old city with large multistory buildings that modern manufacturing and process wouldn't fit into…those kinds of places would be suitable for light manufacturing like the Makers Movements, which fits very well."

However, while the Makers Movement seems like a good fit, logistically and economically, he warned that at least a sizable portion of those companies will need to be able to, "scale up and hire others, which is really the benefit for this city and this country; when people start doing more and building. Until it starts generating jobs, it's going to be hard to consider [the Maker Movement] as a main sector of the economy."

Kevin Hunter, a Policy Analyst for the City spoke to the same effect, stating that, "While [the Maker Movement] is important, we can't forget large scale industrial users. As much as we should be fostering this type of Maker type economy you also have to look at the bigger picture in terms of jobs. [The Maker Movement] is a critical piece to the puzzle but not necessarily an entire segment of the story."

The idea of a Maker Movement occupying historical industrial sites and driving economic growth in Philadelphia may not be the reality currently, according to local planners, but an alternative land use plan that could facilitate both small and large-scale emerging craft and manufacturing is currently getting some traction. The recently completed industrial development where Philadelphia has seen success from the effects of their industrial use plan is The Navy Yard.

Once a military shipyard, the centrally located 1200 acres of public-private land have been drastically transformed into five subdistricts to accommodate businesses and activity of different types:

District Name	**Acres/Square Feet (Sq.ft.)**	**Uses**
Central Green District	72 acres, 110,000 sq.ft.	Office, retail, parking
Historic Core	167 acres, 2.4 million sq.ft.	Office, residential, retail
Mustin Park District	81 acres, 668,000 sq.ft.	Office, flex, light manufacturing
Canal District	38 acres	Office
Port Expansion Area	192 acres	Seaport, and port activities for distribution

Table 2: The Navy Yard Districts

Figure 6: The Navy Yard Master Plan Cover Photo

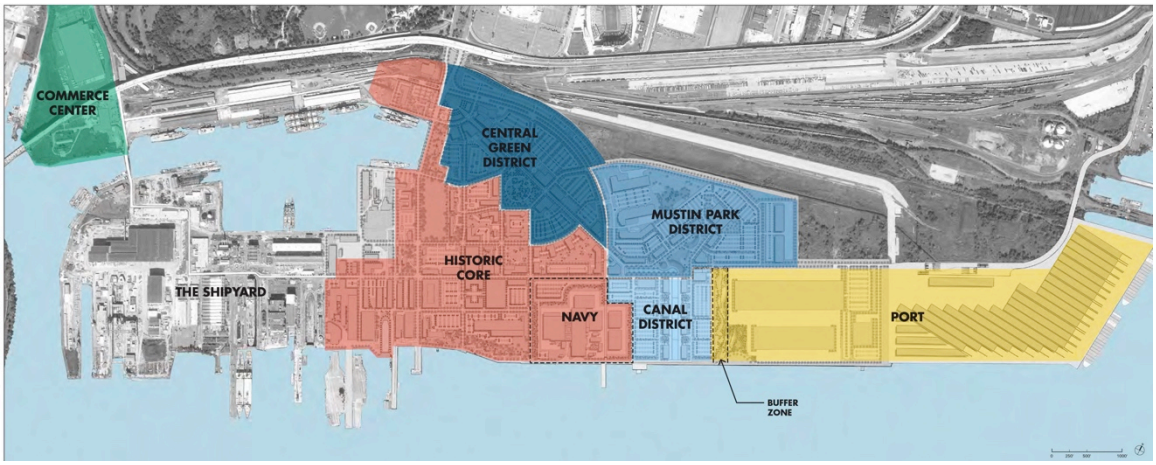


Figure 7: The Navy Yard Districts

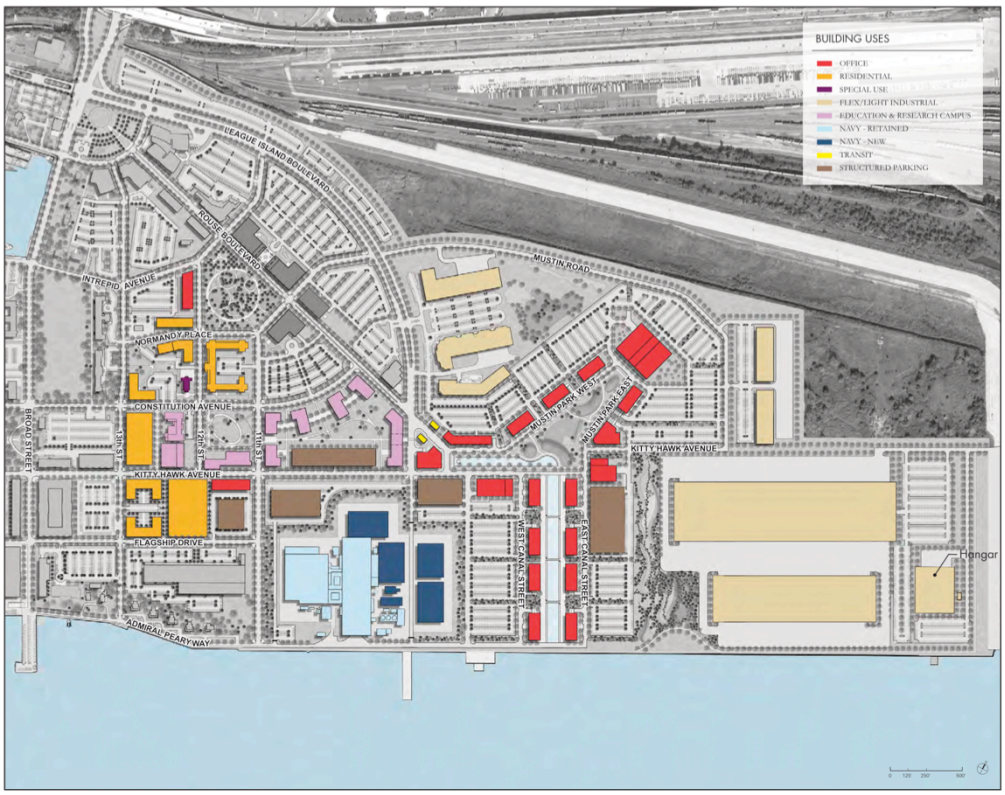


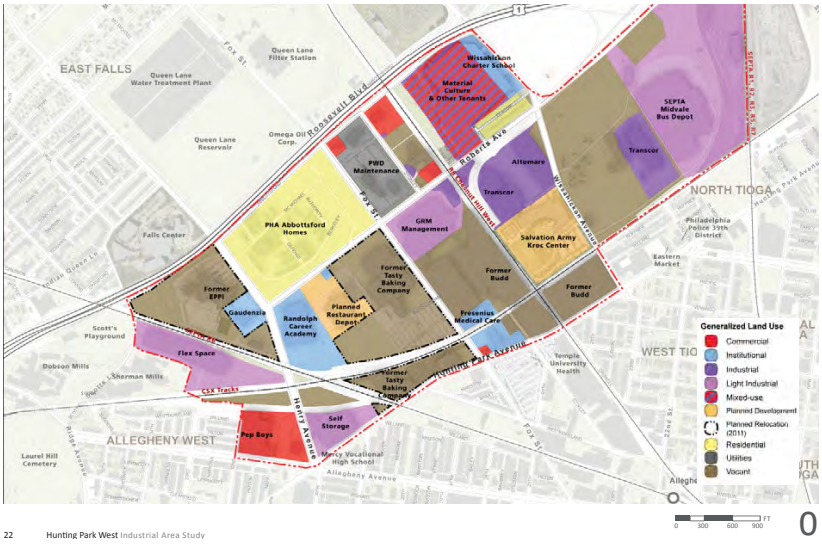
Figure 8: The Navy Yard Building Uses

Currently, The Navy Yard is home to 152 companies and organizations, including the headquarters for Urban Outfitters, Liberty Property Trust, GlaxoSmithKline, Unique Industries, WuXi AppTec Laboratory Services, Rhoads Industries, Iroko Pharmaceuticals, and the manufacturing location for Tasty Baking Company.

The site also boasts place making and entertainment for both locals and residents of the districts. Public parks, pedestrian and bicycle paths, as well as access to the waterfront are features in the area. Public events and recreational activity, including golfing, and fishing from the Sports Complex and integration of residential activity in the Historic Core all provide vibrancy and activity to the area outside of working hours.

When speaking with Philadelphia's planners, all had referenced The Navy Yard campus as a positive program to mix industrial activity with other land uses.

The Navy Yard along with an industrial cluster called Hunting Park West are two of Philadelphia's identified areas ripe for preserved light industrial areas under the recommended zoning (Pimlus 2010). Hunting Park West is a 400-acre historically industrial use area once home to landmark Philadelphia institutions and companies (Philadelphia City Planning Commission 2010). Its recommended land use from a 2010 report on reviving the area suggests adaptive reuse of several existing buildings into residential, commercial mixed-use, light industrial, industrial mixed-use, and residential mixed-use. This scenario is a contrast from the area's existing separation of all land uses, except for one parcel of mixed-use.



22 Hunting Park West Industrial Area Study

Figure 9: Hunting Park West Existing Land Use

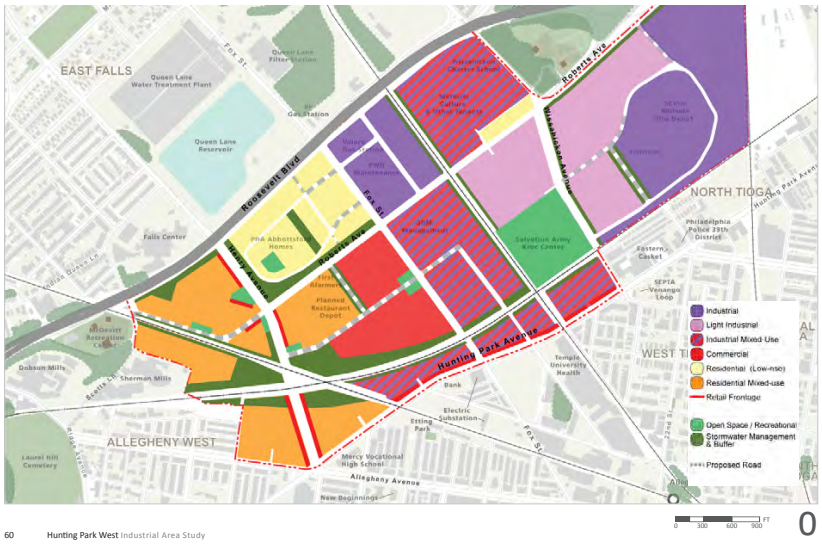


Figure 10: Hunting Park West Proposed Land Use

In industrial mixed-use zones, artisanal, creative, workshop, and small manufacturing companies are characteristics of these areas (Pimlus 2010). These are predominantly flex space and adaptive reuse, such as a fabrication and metal finishing company called Lightfast Build located in a flex space building in the Lower American Street Neighborhood (McReynolds 2013) or The Loom, a former textile mill that now has studios, offices, and warehouses for rent (Patten 2013). While these examples might seem like the products of trend, they pose as case studies for what Philadelphia is accepting and promoting for their new mixed-use industrial zones.

By incorporating existing historic buildings and network of connectivity into the city, the district plan seeks to blend seamlessly into the urban fabric, without imposing itself as a more distinct master planned development. For new industries and emerging economies, districts like this are beneficial models for growth.

SAN FRANCISCO, CA

Overview of San Francisco's Industrial Land Use

San Francisco is a tight and expensive market for all types of development due to its limited land area and high demand from businesses and potential residents. With a drastic influx of economic activity and residential demand and an intense need for housing, the competition for existing industrial land is a fight the City contended with back in the early 2000's. Commercial and residential developers were vying for inexpensive industrial parcels in the Eastern Neighborhood, and this has become a focus for the City's planners. When interviewed on the phone, a planner (name omitted) in San Francisco's Planning Department reflected,

"At the time, there was a large group of people who thought we needed to keep these blue-collar jobs…if we don't have the auto body shops and we don't have the UPS distribution centers and we don't have even any small manufacturing, you want [to provide] social and economic diversity" (City Planner in San Francisco, 2016).

Consequently, San Francisco identified Mission, Potrero Hill, Showplace Square, East SOMA, the Central Waterfront, and the Port of San Francisco as industrial land hubs. Comprised of 3,254 acres, or about 14 percent of the City's total land area, half of the land was already programmed for major redevelopment or owned by the Port of San Francisco (San Francisco Planning Department 2002). The remaining 1,654 acres of land were then slated and considered suitable for mixed-use development in the neighborhood and concept plans, leaving 7 percent of industrial land to work with.

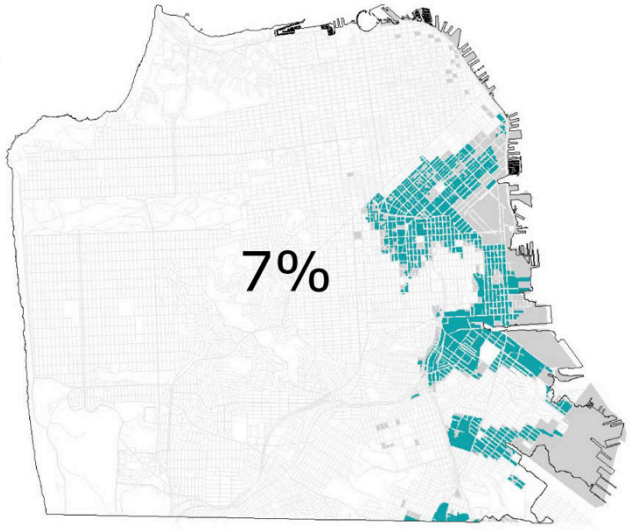


Figure 11: Percentage of San Francisco's Industrial Land

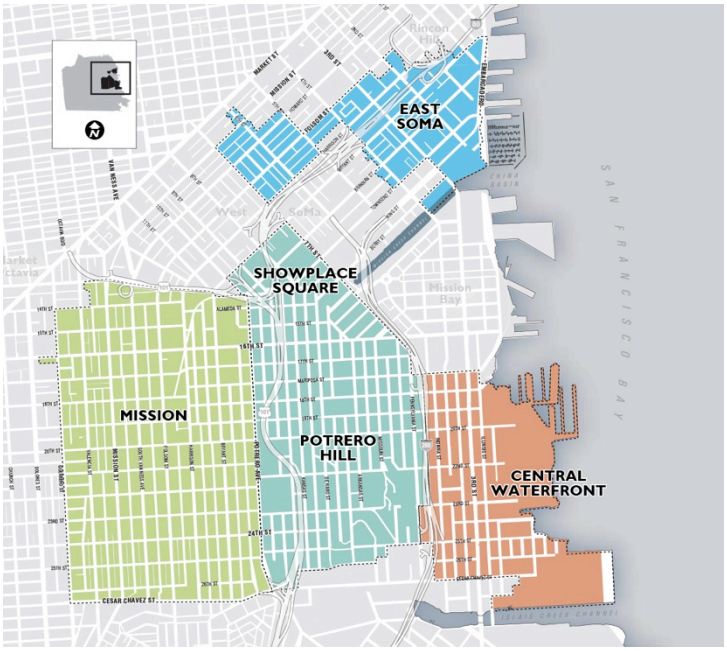


Figure 12: San Francisco Industrial Neighborhoods 2008

The City then adopted a term called Production, Distribution, and Repair (PDR), which is a more appealing and flexible designation for industrial land uses. PDR zones essentially allow for mixed-use to incorporate industrial with retail, and commercial and locate adjacently to existing and new residential land uses so as not to withdraw any other uses from the land. Jobs that fall under PDR are as follows:

Production	**# of Jobs**	**Distribution**	**# of Jobs**	**Repair**	**# of Jobs**
Manufacturing	8,500	Wholesale	11,500	Contractors	8,400
Construction	6,500	Transportation	8,200	Auto	2,600
Printing & Publishing	3,700	Utilities	3,500	Repair	1,100
Audio, Film, & Video	2,400	Distribution	2,700		
Media	1,800				

Table 3: Production, Distribution, and Repair (PDR) Jobs in San Francisco 2014

As of 2014, PDR areas accounted for 63,000 jobs, or 10 percent of the workforce in San Francisco. The City projects this sector to grow with the rise of a strong economy, increased interest in urban manufacturing, and a very low industrial vacancy rate of 6 percent (Wertheim 2014). PDR jobs are seen as a necessary economic driver for existing industries in tech, tourism, financial, and legal services. PDR businesses also tend to provide stable and well-paying jobs for the 55 percent of all residents ages 18-64 who do not have a degree from a 4-year college (Back Streets Business Advisory Board 2007, San Francisco Planning Department 2008). In a city whose land values are two times more than any other major U.S. city, eliminating an entire middle class by relocating their jobs while not offering opportunity for growth in entrepreneurial activity is very problematic. The City also needs to keep in mind the issue of maintaining low industrial land values so as not to allow mixed-use parcels to increase in value, especially when the trend for industrial use zones tend to be valued lower. It would disregard the purpose of accommodating new residential, office, and industrial in one area ultimately for those who cannot otherwise afford to live in San Francisco.

Programs and Policies to Maintain Industrial Land Use

Fortunately, San Francisco's planning department has made great strides to protect industrial PDR land. 1,274 acres, or 5.6% of land is being protected and being allowed as-of-right in mixed-use districts (Wertheim 2014). The process for creating PDR businesses has become less treacherous and with less regulatory cost. The City also has a strong relationship with SFMade, a non-profit that helps build and support the manufacturing sector that, "…sustains companies producing locally-made products, encourages entrepreneurship and innovation, and creates employment opportunities for a diverse local workforce" (SFMade 2010).

Another initiative the city has implemented is the creation of the Back Streets Business Advisory Board to assist small businesses and manufacturing companies succeed in the competitive San Francisco market. The *Made in San Francisco Report* describes a sector of "behind-the scenes" businesses that have been neglected during the economic boom. They consider Back Street Businesses as small to medium-size industrial or commercial businesses that create products or provide services in manufacturing, wholesale, commercial, logistics, construction, repairs, and food processing. A few businesses the report highlights are animal day and night care businesses, advanced technical sewing, alloy welding – companies who have existed in San Francisco for a long time but have been continuously been removed from their locations, unable to find suitable spaces where they can operate their businesses without interfering with the neighborhood or not being placed in inappropriate areas, such as a noisy pet care store next to a senior center (Back Streets Business Advisory Board 2007).

However for some companies, land or space is not necessarily the issue but rather the lack of technical labor. While PDR space is being created, the labor pool qualified to perform the work necessary is shrinking.

To help with new businesses, San Francisco has an in-depth online business portal that shows step-by-step processes for creating a business plan and a compilation of resources provided by the City.

To entice labor, The Office of Economic and Workforce Development (OEWD) has created a strategic plan for engaging young and adult talent, mainly in technical fields required by Back Streets Businesses and emerging small businesses. Through its CityBuild Academy, OEWD collaborates with a local high school, John O'Connell High School, in order to focus on construction trades. The Young Adult WorkLink is a program to help students who require academic and skill building in order to achieve economic stability. Mainly, OEWD has effectively partnered with the San Francisco school district to create programs for students who need assistance in finding a trade or exposing them to alternative means of work available in the city. These opportunities are also available for adults through Sector Bridge Programs and Career Pathway Programs in Demand Industries (Office of Economic and Workforce Development 2013).

This is an important mechanism to encourage a Maker Movement in the birthplace of the initial Maker Faire. San Francisco is, indeed, the original home to what is now labeled the maker movement, which evolved from the bay area's existing population of tech and science-based industries. With the rise of urban manufacturing businesses in San Francisco, a multitude of resources have spawned from the start-up tradition that have been prominent throughout the City and broader region. Organizations, such as SFMade and PlaceMade were created from the rise of a Maker Movement and the manufacturing rise in the City. SFMade has been most influential in bridging the gap between businesses and the City for voicing the concerns and needs of the small business community and helping them navigate through the business bureaucracy by guiding business owners through City regulations. The organization PlaceMade partners with SFMade by working with private property owners to help them renovate industrial buildings or build new buildings that will be permanently affordable

and serve the manufacturing sector (PlaceMade 2015). PlaceMade not only provides real estate and financial counseling to burgeoning businesses, but pairs with local affordable housing non-profit developers to create similar affordable industrial spaces (Sciacca 2015). With the help of City resources and non-profits or organizations empowering businesses, a Maker Movement may be able to find it easier to work and find space in San Francisco than in the past. According to Deloitte's research on the Impact of the Maker Movement, jobs in the manufacturing sector doubled in San Francisco, from 2,500 in 2011 to 4,000 in 2014 (Deloitte 2014). As this is during the time of a boom in maker resources, a correlation can be seen between manufacturing growth and Maker Movement resources, such as SFMade and PlaceMade.

Year	**Number of SFMade Companies**
2010	0
2011	250
2012	403
2013	512
2014	540

Table 4: Number of SFMade Companies

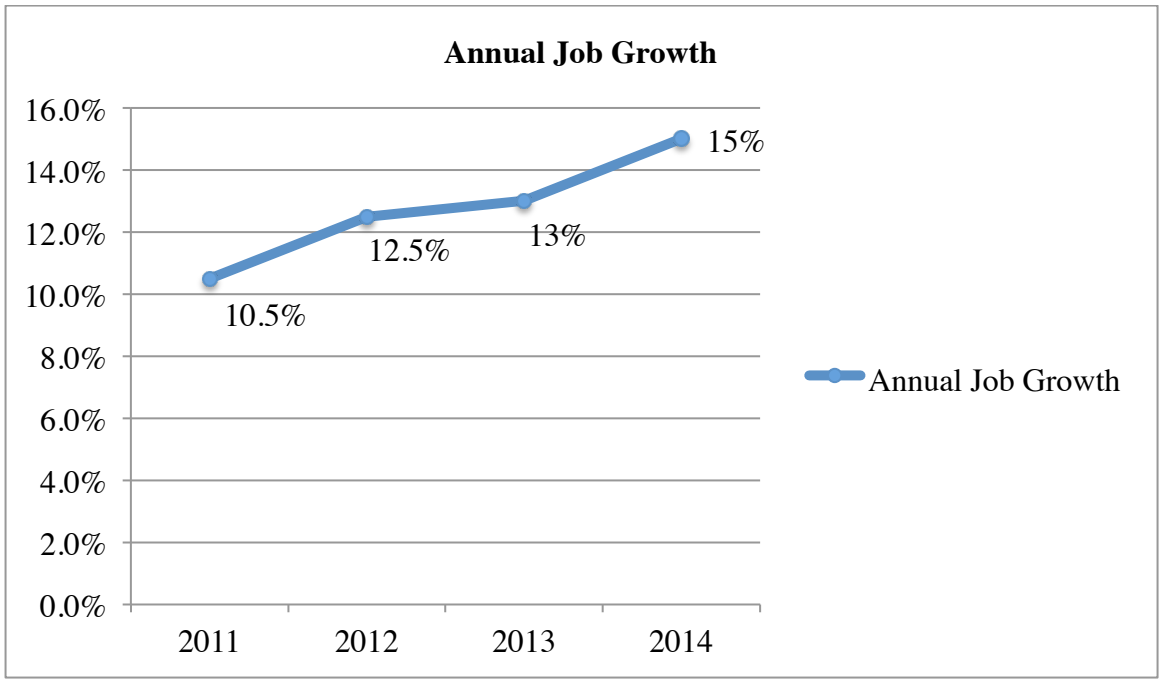


Table 5: Annual Job Growth

According to SFMade's 2014 State of Local Manufacturing Report, "San Francisco's local manufacturing sector now employs well over 4,000 individuals, over 70% of whom are from lower-income households and diverse communities representing immigrants, veterans, and youth. The sector continues to pay well above minimum wage for most entry-level positions and offers a wide variety of jobs, real opportunity for advancement, and alternative entry points for individuals with less advanced education or other barriers to employment" (SFMade 2014).

Developers, realtors, and incubators have begun to add PDR space to their selection of spaces. Kilroy, a realty firm in San Francisco, is listing a 400,000 SF site of creative office and ground floor PDR in the Mission Bay neighborhood. The building is to be completed by 2017.

Figure 13: New Creative Office/PDR Building in San Francisco

In a SPUR presentation on the Maker Economy in San Francisco, City Planner Corey Teague showcased a few maker companies who successfully transformed PDR spaces from antiquated factories into new and alluring spaces of manufacturing (See Figures 14-16).

Opinions on Maker Movement in the City

In contrast to Philadelphia's concern about the overall job growth potential of Maker Movement type businesses, San Francisco sees the Movement as a set of sectors that is needed and important for the City. The planner that I spoke with stated that the Maker Movement, "is still 10 percent of the PDR sector, but the kind of the sector you want." He anecdotally commented that, "When the mayor is holding up a dildo from one of the local dildo makers at a fundraiser, people notice, as opposed to a car repair shop." Essentially, creative manufacturing companies are a somewhat new concept in urban areas, and similar to the Back Streets Businesses dilemma of being overlooked as a part of San Francisco's economy, manufacturing is also one of the sectors that proudly does and should exist in the City.

"While the makers who start these businesses tend to be highly educated artisans who can afford to live in San Francisco, they want to be in industrial neighborhoods where there are more amenities for their company." In defining amenities, the availability of manufacturing employees without a college education who are otherwise being evicted from the City due to high costs are the resources sought out by makers for new boutique urban industries. This also brings in the issue of residential mixed-use. Living in an apartment beside a light manufacturing business may not be everyone's cup of tea. However, the demographic that is typically attracted to San Francisco chooses to move to the city for its values in density and mixed-use. For some, it would be novel to live next to a sourdough bakery.

An example of a successful maker company in San Francisco is Heath Ceramics who converted Mission Laundry, an industrial space, into a PDR mixed-use space complete with a kiln and pottery factory, as well as retail space for selling their product. Created in 1948 in Sausalito, California, Heath Ceramics opened their first retail space in San Francisco in 2012, followed by their tile factory in the same space. They currently employ 24 people in various roles from production to designing, installation, and management. As mentioned, Corey Teague sees Heath Ceramics as a positive example of how to repurpose PDR zones into mixed industrial and retail businesses, while also employing locals in diverse socioeconomic statuses.

Overall, it seems San Francisco sees the Maker Movement as a positive addition to the fabric of the city, which may have stemmed the City's drastic loss of economic and educational diversity over the past decade. Perhaps the City has responded very late in the game, but their industrial zoning, workforce training and business development initiatives suggest that the city is seeking to maintain a degree of diversity in its industries and its workforce.

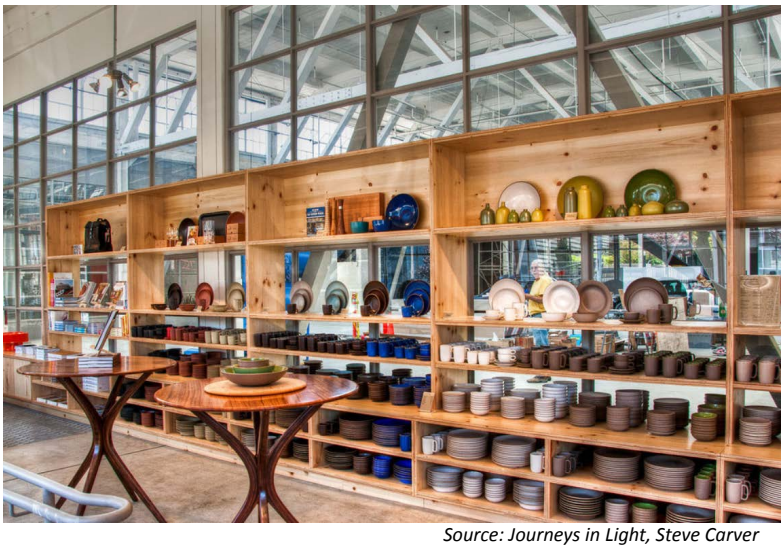
MISSION LAUNDRY

Source: Journeys in Light, Steve Carver

Figure 14: Heath Ceramics Industrial Space Conversion from Mission Laundry in a PDR Zone

Figure 15: Employees at Heath Ceramics Following their Industrial Space Conversion from Mission Laundry in a PDR Zone

HEATH CERAMIC RETAIL SPACE



Source: Journeys in Light, Steve Carver

Figure 16: Heath Ceramics Retail Space

NEW YORK CITY, NY

Overview of New York's Industrial Land Use

Similar to San Francisco, New York City has seen immense growth in demand for residential and commercial development in the last decade. But similar to Philadelphia, NYC was once an industrial mecca and center for of a lot of 19th to mid-20th century innovation in manufacturing. From the garment producers and printers of the Manhattan loft districts, to the sugar refineries and heavier industries of the East River waterfront, the manufacturing sector was once the city's dominant economic engine (New York City Council 2014). By 1910, the City was 40 percent manufacturing. Today, industrial jobs account for about 10 percent of New York City's private sector workforce (New York City Council 2014). According to the New York City Council's report, total manufacturing employment in the City has stabilized since 2010 and is showing new signs of growth.

Revised land use regulations may be contributing to the City's recent revival of manufacturing activity. New York has been following 1961 land use zoning that divided manufacturing districts into three segments: M1 for high performance, less polluting/noisy manufacturing, M2 for medium performance, and M3 for low performance and open industrial uses like power plants and scrapyards. The reasons for this separation was to safeguard residential and commercial communities from noxious fumes and sounds and to encourage industry to operate at higher environmental and noise standards. The problem with these divisions is that despite being zoned manufacturing, other types of uses were allowed to be located in these zones, including hotels, restaurants, and retail. Overt time, industry was pushed out of the city and in 1997, Mayor Giuliani created Special Mixed-use District (MX) zones to create a form of PDR's where light industrial can mix with residential, commercial, and office - mainly to preserve the aesthetics of traditional neighborhoods that were being transformed into big box store properties. However, there was a loophole in MX. If an MX zone replaces an M zone or a previous special-mixed-use district with rules on protecting manufacturing uses, it can essentially function as a residential rezoning (New York City Council 2014). Residential and commercial uses ruled and took over neighborhoods such as Williamsburg, as fast as people could move in.

Programs and Policies to Maintain Industrial Land Use

Once Mayor Bloomberg came into office, nearly 1,800 acres of land were rezoned to other uses, reducing manufacturing space by 20 percent (Pratt 2009). New York still did not see the value of industrial land and it potential contribution to economic and job diversity. By 2005, Mayor Bloomberg's administration had created 15 new Industrial Business Zones (IBZ's) where the City pledged to support the retention and expansion of industrial businesses through tax credits and promised to maintain industrial zoning and

to monitor and strongly discourage the Board of Standards and Appeal (BSA) from granting variances in these areas (New York City Council 2014).

Under the new IBZ districts, the City promised to:

1. Guarantee not to rezone to allow residential uses
2. Provide new relocation credit for industrial businesses
3. Conduct area planning to identify individual IBZ solutions
4. Market IBZs to new, expanding or relocating businesses

According to reports, these provisions were not enforced carefully and many loopholes worked against the intent of the policy. Commercial land uses in the Southwest Brooklyn IBZ had more than doubled since 2005 with the "as-of-right" conversion of over 2.3 million square feet of industrial space (Hum 2016).

Southwest Brooklyn is the location of a 6 million square foot industrial commercial, private facility called Industry Space. This facility is touted as being a true industrial, manufacturing makerspace - even specifically marketed toward the Maker Movement. On Industry City's material, they use key words such as collaboration, crosspollination, demonstrating the exact foundation of the maker movement experience. Except, the spaces in Industry City are largely commercial. Tarry Hum from MetroPolitics.eu states, "Industry City is being rebranded and remade from an industrial into a commercial hub that attracts all types of "makers" ranging from the Brooklyn Nets (who will soon have a new training facility with a rooftop terrace) to artisanal manufacturers paying an average $20 per square foot in rent" (Hum 2016).

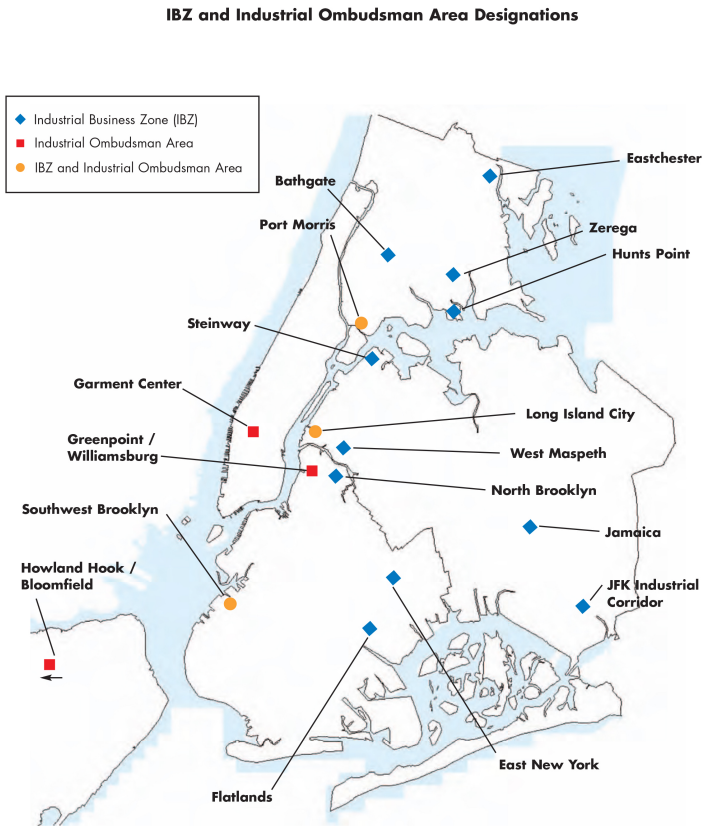


Figure 17: New York City IBZ Districts

Figure 18: Industry City development in Brooklyn's Southwest Brooklyn IBZ

In actuality, Industry City is just a commercial space for big name companies in a building evoking resonance of old fashioned industrial grunge. New York City has the right idea in IBZ, but may need to readdress what an industrial economy really means and looks like.

Despite the controversy, New York City does in fact offer funding and assistance related to its Industrial Action Plan. The plan includes the creation of a $150 million loan and grant fund to spur the development of affordable housing and manufacturing space; $37 million to support 36,000 existing jobs and 13,300 new innovation economy jobs (City of New York 2005).

FutureworksNYC has leveraged up to $10 million in both public and private resources for the creation of an Advanced Manufacturing Center that intends to directly support over 3,000 jobs. Whether it's just money the City is claiming as a support or a more integrated plan for innovation around manufacturing remains an open question.

While the Maker Movement can find financial assistance in New York, it seems that a fight for affordable space may be an issue when real estate developers continue to hijack land in the defined industrial districts for other uses. Companies are also redefining what they perceive to be a Maker in order to suit their business or development purposes.

Instead, the City may need to more seriously heed the New York City Council 2014 report's recommendations for the reform of industrial land so that it is benefiting the true manufacturing communities and not just commercial developments.

Conclusion

Industrial space not only represents an important economic opportunity for cities, but also can help sustain a diversity of people to live in urban areas that are experiencing a broad process of displacement of lower and middle class residents. With the increasing population of the country's biggest cities, housing prices, and rising rents, affordability is quickly disappearing. Cities can't sustainably function on high-income enclaves with service and higher end retail industries. Economic and job diversity is essential for cities to function and industrial manufacturing is part of the solution. In addition, offering the capability for people to be able to create businesses and fulfill their professional endeavors shouldn't be controlled by the few who can actually afford to run a business in high priced urban areas. Maintaining industrial land for the purpose of job growth and emerging economies should be an important objective of all cities.

The questions asked in this report are the same questions cities should be evaluating. The first one being, to what extent have US cities reallocated industrial land to other uses? As Nancey Green Leigh found, 8 select urban cities collectively lost over 9,000 acres of industrial land between spans of 5 to 19 years (Table 1). San Francisco leads the group with a loss of 46 percent of industrial land between 1990 and 2008 (Green Leigh 2015) (PIMLUS 2010). Of the 14 percent of remaining industrial land, half has been allocated for mixed-use development leaving 7 percent ready and available for solely industrial purposes (San Francisco Planning Department 2002). While Philadelphia only lost 8 percent of industrial land between 1990 and 2008, its economy plummeted during the 1970's and the city lost 22 percent of its population (Green Leigh 2015). Consequently, industrial manufacturing was once considered a bygone sector and the city has been sitting with 17,800 of industrially zoned land. And then New York traded in 14 percent of its industrial land between 2002 and 2007 for a manufacturing zoning code called a Special Mixed-use District (MX) that furtively allowed for residential and commercial uses instead of its intended purpose.

Seeing this effort to decrease industrial land demonstrates how cities view the decline of manufacturing, which raises the second question: is there any evidence that the diminishing availability of industrially zoned land is constraining manufacturing and goods making activity in US cities? Decentralization of manufacturing from urban areas dramatically affected industrially based cities as manufacturing relocated to rural or offshore locations. As a result, urban cities were forced to adopt alternative forms of economies that we now see in the surge of service, tech, and financial sectors predominantly located in the largest U.S. cities. Now that manufacturing firms are returning to cities, the necessary land is not as available as it used to be.

In San Francisco's *Supply/Demand Study for PDR* report, they found that 27 million total square feet of Production Distribution Repair (PDR) land would be required for future PDR businesses in 2030. At the time of the report in 2005, San Francisco could only provide 10 million square feet for these uses (Economic & Planning Systems 2005). Washington, DC found that it would need 100 more acres of private and public land to accommodate the projected growth for PDR zoned areas (Phillips Preiss Shapiro Associates 2006). Other cities such as Seattle, have found their industrial sites' vacancy rates to be low, ultimately unable to accommodate prospective manufacturers. In not providing necessary colocation of businesses and manufacturers through industrial land availability, cities are perpetuating decentralization and economic segregation. If manufacturing businesses are forced out of the city, their employees, who represent diverse income stratum, are also evicted from urban areas.

While industrial land can't be created overnight, the third question addresses how might cities use their remaining industrial building stock and zoning to promote emerging craft and entrepreneurial economy activities to promote economic diversity and development. Cities need to:

1. Develop a new narrative about manufacturing and metropolitan economies and use it to inform and guide its programs and policies.

2. Support small urban manufacturers' (SUM) role in regional cluster growth and development.

3. Help ensure that SUMs have the space, infrastructure, and technical assistance they need to grow and thrive (Mistry and Byron 2011).

Start small and then grow big. Philadelphia made an effort to create 15 industrial districts that can accommodate both small and large manufacturing businesses. The City partnered with a public/private developer to create the highly acclaimed Navy Yard to promote business activity mixed with public recreation. Philadelphia also created educational programs in the fields of science, research, engineering, and manufacturing, as well as on-the-job training. Small businesses can apply for loan and grant programs to help fund their ventures.

San Francisco's PDR zoning has creatively partnered with the local non-profit makers group, SFMade. With this support, makers and entrepreneurs can streamline their startup process more efficiently. Additionally, the City and SFMade collaborate with the non-profit development consultant firm, PlaceMade, to assist in creating more usable PDR spaces and promoting the use of mixed-use light industrial buildings. San Francisco has also encouraged educational programs through high schools to inspire employment in manufacturing, which is an important mechanism to help grow the locally created Maker Faire.

New York, while struggling to define what a maker economy looks like, has still dedicated 15 areas as Industrial Business Zones (IBZ). The City also created an Industrial Action Plan that provides a $150 million loan and grant fund to spur the development of affordable housing and manufacturing space; $37 million to support 36,000 existing jobs and 13,300 new innovation economy jobs (City of New York 2005). FutureworksNYC, a City program, intends to directly support 3,000 jobs through an Advanced Manufacturing Center. Despite its murky maker definition as seen through the industrial development site, Industry City, New York has notoriously been a competitive real estate market. Dedicating true industrial land will take a lot of private and public effort.

The three case studies listed in this report are examples of trial and error in maintaining industrial land use. Not every city has the history or the inventory of manufacturing buildings that these cities have. But they can support an entrepreneurial makers economy. And while planners in the field believe the Maker Movement is not yet a primary incentive for retaining industrial stock, there can still be space for it. When dedicating mixed-use land with light industrial, residential, and commercial, perhaps maker companies that fall into a specified definition of Makers, as opposed to a professional basketball team, should have priority for spaces particularly suited to their use in the changing land use fabric. In this way, cities can help support and create emerging economies.

TABLES

FIGURES

Figure 10: The Navy Yard Building Uses. The Navy Yard Master Plan Update 2013. Philadelphia: Philadelphia Industrial Development Corporation (PIDC), 2013. Web. Retrieved from http://www.pidcphila.com/images/uploads/resource_library/The_Navy_Yard_Master_Plan_2013_Update_lo.pdf

Figure 11: Percentage of San Francisco's Industrial Land. *Industrial Land in the Eastern Neighborhoods*. San Francisco: San Francisco Planning Department, 2002. Web. 24 Mar. 2016. Production, Distribution, and Repair Newsletter.
Retrieved from
http://www.sf-planning.org/Modules/ShowDocument.aspx?documentid=3677

Figure 12: San Francisco Industrial Neighborhoods 2008. *Eastern Neighborhood Community Planning*. San Francisco: San Francisco Planning Department, 2008. Web.

Figure 13: New Creative Office/PDR Building in San Francisco. Sanford, Mike. "New Models for a Maker Economy". 2015. Presentation.

Figure 14: Heath Ceramics Industrial Space Conversion from Mission Laundry in a PDR Zone. Corey Teague. Teague, C. (2015). New Models for a Maker Economy: PDR and the Planning Code. Presentation, San Francisco, CA.

Figure 15: Employees at Heath Ceramics Following their Industrial Space Conversion from Mission Laundry in a PDR Zone. HeathCeramics.com; McBride, K. *Issue Snapshot: Heath Ceramics*. Atlas: The Craft and Curio Magazine.
Retrieved from
www.heathceramics.com
http://atlasmag.com/blogs/journal/10129837-issue-preview-heath-ceramics

Figure 16: Heath Ceramics Retail Space. Teague, C. (2015). New Models for a Maker Economy: PDR and the Planning Code. Presentation, San Francisco, CA.

Figure 17: New York City IBZ Districts. City of New York. Protecting and Growing New York City's Industrial Job Bas. New York City: City of New York, 2005. Print.

Figure 18: Industry City development in Brooklyn's Southwest Brooklyn IBZ. Industry City. www.industrycity.com/vision. Web.

BIBLIOGRAPHY

An Industrial Land & Market Strategy for the City Of Philadelphia (PIMLUS). Philadelphia: Philadelphia City Planning Commission, Philadelphia Department of Commerce, 2010. Print.

American FactFinder, U.S. Census Bureau (2012).

Bajarin, Tim. 2015. 'Why The Maker Movement Is Important To America's Future'. Time. http://time.com/104210/maker-faire-maker-movement/.

Bluestone, B., & Harrison, B. (1982). The deindustrialization of America: Plant closings, community abandonment, and the dismantling of basic industry, New York: Basic Books.

Brewers Association (2015). Economic Impact. Retrieved 26 November 2015, from https://www.brewersassociation.org/statistics/economic-impact-data/

Bronstein, Zelda. *Industry and the Smart City*. Dissent 56.3 (2009): 27-34.

Central Waterfront Area Plan. 2008. San Francisco: San Francisco General Plan, 2008.

Chapple, K. "*The Highest and Best Use? Urban Industrial Land and Job Creation*". Economic Development Quarterly 28.4 (2014): 300-313. Web.

City of New York. Protecting and Growing New York City's Industrial Job Bas. New York City: City of New York, 2005. Print.

City of Seattle Department of Economic Development (2005). *Industrial Land Study*. Seattle. Retrieved from: http://www.seattle.gov/Documents/Departments/economicDevelopment/keyIndustries/industrial_land_study_final_91305.pdf

Deloitte Center for the Edge and Maker Media, 2014. Impact of the Maker Movement. Sebastopol: Maker Media.

Dempwolf, Scott. *An Evaluation Of Recent Industrial Land Use Studies: Do Theory And History Matter In Practice?* College Park: University of Maryland, College Park, 2009. Print.

Dougherty, Dale. *The Maker Mindset*. Cambridge: MIT, 2013. Retrieved from https://llk.media.mit.edu/courses/readings/maker-mindset.pdf

Eastern Neighborhood Community Planning. San Francisco: San Francisco Planning Department, 2008. Web.

Engines of Opportunity: Reinvigorating New York City's Manufacturing Zones for the 21St Century. New York City: The New York City Council, 2014. Print.

Facts About Manufacturing. Washington, DC: Manufacturing Institute, MAPI, National Association of Manufacturers, 2012. Print.

Howland, Marie (2010) *Planning for Industry in a Post-Industrial World*, Journal of the American Planning Association, 77:1, 39-53, DOI:10.1080/01944363.2011.531233

Hunting Park West: Reviving Philadelphia's Industrial Lands.
Industrial Land Conversion Assessment. Milpitas: Conley Consulting Group, 2007. Web. 24 Mar. 2016. For The City Of Milpitas.
Retrieved from
http://communityinnovation.berkeley.edu/presentations/industrial/CA-Milpitas-Industrial-Assess.pdf

Industrial land in a post-industrial city District Of Columbia Industrial Land Use Study. District of Columbia: Phillips Preiss Shapiro Associates, Inc., 2006. Web. District of Columbia Office of Planning. Retrieved from
http://communityinnovation.berkeley.edu/presentations/industrial/DC-industrial-land-in-a-post-industrial-city.pdf

Industrial Land in the Eastern Neighborhoods. San Francisco: San Francisco Planning Department, 2002. Web. 24 Mar. 2016. Production, Distribution, and Repair Newsletter.
http://www.sf-planning.org/Modules/ShowDocument.aspx?documentid=3677

Leigh, Nancy Green, and Nathaniel Z. Hoelzel. 2015. 'Smart Growth's Blind Side'. Journal of the American Planning Association.

Lester, T., Kaza, N., & Kirk, S. (2013). Making Room for Manufacturing: Understanding Industrial Land Conversion in Cities. Journal of the American Planning Association, 79(4), 299-300. Retrieved from
http://www.tandfonline.com/doi/full/10.1080/01944363.2014.915369

Lewis, Robert D. *Manufacturing suburbs: Building home and work on the metropolitan fringe*. Philadelphia, PA: Temple University, 2004. Print.

List of Hacker Spaces - HackerspaceWiki. (2016). Wiki.hackerspaces.org. Retrieved 14 April 2016, from https://wiki.hackerspaces.org/List_of_Hacker_Spaces

Made In San Francisco. San Francisco: Back Streets Business Advisory Board, 2007. Web.

McReynolds, Devon. (2013). *Uncertainty And Ingenuity On Kensington'S Industrial American Street*. Hiddencityphila.org.
Retrieved from
http://hiddencityphila.org/2013/06/uncertainty-and-ingenuity-on-kensingtons-industrial-american-street/

Mistry, Nisha, & Byron, J. (2011, April 11). *The federal role in supporting urban manufacturing*. Washington, DC: What Works Collaborative, Pratt Center for Community Development, and Brookings Institution.
Retrieved from
http://www.areadevelopment.com/article_pdf/id61372_04_urban_manufacturing_mistry_byron.pdf

New York City Economic Development. (2013, October). *State of Local Manufacturing*.
Retrieved from
https://www.nycedc.com/sites/default/files/filemanager/State_of_Local_Manufacturing_Oct_2013.pdf

Patten, Zach. (2013, July 29). *Footsteps to Follow: Ten Examples of Effective Adaptive Reuse*. Philly.curbed.com. Retrieved
http://philly.curbed.com/maps/ten-examples-of-good-adaptive-reuse

PlaceMade. N.p., 2016. Web. 26 Mar. 2016. www.placemade.org

Pratt Center for Community Development, 2009. *Protecting New York's Threatened Manufacturing Space. New York: Pratt Center for Community Development*.
http://www.thirteen.org/home/images/large/pratt-center_threatened-manufacturing.pdf

Philadelphia's Changing Middle Class. Philadelphia: The Pew Charitable Trusts, 2014. Print. The Pew Charitable Trusts.
Retrieved from
http://www.pewtrusts.org/~/media/legacy/uploadedfiles/wwwpewtrustsorg/reports/philadelphia_research_initiative/priphiladelphiachangingmiddleclassreportfebruary2014pdf.pdf?la=en

Price, Gary. *Results From Makerspaces In Libraries*. Study Released | LJ Infodocket, 2013. Infodocket.com. N.p., 2016. Web. 14 Apr. 2016.
http://www.infodocket.com/2013/12/16/results-of-makerspaces-in-libraries-study-released/

Sanford, Mike. "New Models for a Maker Economy". 2015. Presentation.

SF Made. 2010. http://www.sfmade.org/

SFMade. (2014). *State of Local Manufacturing Report*.
Retrieved from
http://www.sfmade.org/new/wp-content/uploads/2014_SLMReport.pdf

San Francisco Zoning Map. 1st ed. San Francisco: San Francisco Planning Department, 2015. Retrieved from
http://www.sf-planning.org/modules/showdocument.aspx?documentid=9016

Sciacca, Annie. (2015, April 21). *How SFMade is expanding San Francisco's manufacturing space*. San Francisco Business Times.
Retrieved from
http://www.bizjournals.com/sanfrancisco/blog/2015/04/sfmade-manufacturing-space-sf-100-hooper-st-makers.html

Supply/Demand Study For PDR In San Francisco's Eastern Neighborhoods Report. San Francisco: Economic & Planning Systems, 2005. Web. 24 Mar. 2016.
Retrieved from
http://www.sf-planning.org/Modules/ShowDocument.aspx?documentid=1929

Hum, Tarry. *The Hollowing-Out Of New York City's Industrial Zones - Metropolitics*. Metropolitiques.eu. N.p., 16 Feb 2016. Web. Retrieved
http://www.metropolitiques.eu/The-Hollowing-Out-of-New-York-City.html?utm_content=buffer71776&utm_medium=social&utm_source=twitter.com&utm_campai%E2%80%A6 from

The Manufacturing Task Force: Annual Progress Report 2015. Philadelphia: Office of Manufacturing & Industry, 2014. Print.

"The Navy Yard ". Navyyard.org. N.p., 2016. Web. 26 Mar. 2016.

Wertheim, Steve. "*Production, Distribution, and Repair in San Francisco*". 2014. Presentation. Retrieved from
http://www.sfplanning.org/ftp/files/Commission/presentations/cpc_Production_Distribution_Repair_SF_06-12-14.pdf

Wilhelm, Paul A. *Industrial Development Planning*. Journal of the American Institute of Planners 26.3 (1960): 216-223. Web.

Workforce Strategic Plan: 2013-2017 Workforce Investment San Francisco. San Francisco: Office of Economic and Workforce Development, 2013. Print.

2015 Public Perception of Manufacturing. 5th ed. Washington, DC: Deloitte, Manufacturing Institute, 2016.